

Notes

Oviposition records and larval foodplants of butterflies in the Atlas Mountains of Morocco

Larval foodplants have been recorded for some Moroccan butterflies, but knowledge of them is still poor (Higgins & Riley, 1980; Rungs, 1981). A substantial proportion of species have no recorded hostplants, and many that do probably also feed on other unrecorded plant species. We visited the Middle and High Atlas in Morocco during May and June 1982 to record oviposition and larval hostplants, mostly of Lycaenids. The results are presented in Table 1.

Most of these butterflies occurred only where their hosts grew in particular situations. For example, *Cigaritis allardi* tended to lay upon smaller than average (<40 cm diameter and <35 cm tall), somewhat isolated *Cistus salvifolius* plants, despite being adjacent to extensive, dense, tall stands of *C. salvifolius*. *Plebejus martini* laid mostly on *Astragalus incanus* plants growing adjacent to bare ground. *Scolitantides bavius* Eversmann eggs were found only on 1-2 cm tall buds of large (>300 cm²) *Salvia argentea* specimens.

Euphydryas desfontainii Godart laid batches of one to three eggs on the undersides of *Knautia* leaves. *E. aurinia* Rott. in Britain lays much larger egg clusters (often 200 or more; Porter, 1981). In North America, *Euphydryas* also varies in this respect within and between species (Ehrlich et al., 1975; M. C. Singer, pers. comm.).

It is interesting that certain not-closely related plant families (in different orders; Heywood, 1978) are used as larval foodplants by several Lycaenids, but that those used do come from a restricted suite of plant families; mostly Leguminosae, Cistaceae, Geraniaceae, Ericaceae and Labiatae in Morocco. For example, Leguminosae and Cistaceae are probably used by *Cigaritis allardi* and *Lampides boeticus*, Leguminosae and Labiatae by *Pseudophilotes abencerragus*, Cistaceae and Geraniaceae by *Aricia agestis*, and Leguminosae and possibly Ericaceae by *Plebejus martini* (*P. martini* also occurs in heathy places; Higgins & Riley, 1980). British *Plebejus argus* use Leguminosae, Ericaceae, Cistaceae and occasionally Labiatae (Thomas, 1983), whilst the endemic Moroccan *Plebejus vogelii* feeds upon *Erodium cheilanthifolium* (Geraniaceae) (Rungs, 1981).

It is unclear whether these plant families share particular mechanical or biochemical attributes (e.g. high Nitrogen and water, or low tannins). Many Lycaenid larvae specialise on soft nutritious meristematic and reproductive growth (Robbins & Aiello, 1982; Thomas, 1983; Chew & Robbins, 1984). Considering the breadth of diet of some species, it seems likely that the nutritional or mechanical attributes of the foodplants may be more important than secondary compounds in determining which species are included in their diets. Alternatively, they may just happen to be the most abundant dicotyledonous plant families in habitats favoured by these Lycaenids for other reasons.

Because these plant families are often unrelated, a coevolutionary explanation (Ehrlich & Raven, 1964) does not provide a convincing explanation for host use by many Lycaenids.

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Note. Butterfly nomenclature follows Higgins & Riley (1980), except where butterfly authors are given.

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Table 1. Larval foodplants and oviposition records for butterflies in the Atlas Mountains of Morocco. Records given in brackets are those quoted by Rungs (1981) and Higgins & Riley (1980). Unpublished records of R. Mattoni (*in litt.*) are marked with *. E = eggs found in wild, no oviposition seen. 0 = oviposition in wild. P = oviposition in wild and subsequently plant was acceptable to first instar larvae in captivity. L = wild larvae found feeding.

Butterfly	Foodplant	Locality	Altitude
PAPILIONIDAE			
<i>Zerynthia rumina</i>	P <i>Aristolochia longa</i> L. subsp. <i>paucinervis</i> (Pamel) Batt.	1	1400 m
	E/P/L <i>Aristolochia</i> species (<i>A. boetica</i>)	2, 8	1600-2100 m
PIERIDAE			
<i>Aporia crataegi</i>	L <i>Crataegus laciniata</i> Ucria (<i>C. monogyna</i> , <i>Pieris malus</i> & <i>P. communis</i>)	3	2100 m
<i>Colias crocea</i>	O <i>Medicago polymorpha</i> L.	1	1100 m

	O	<i>M. sulcata</i> Desf. (<i>M. sativa</i> , <i>M. lappacea</i> & <i>M. hispida</i>)	1	1100 m
LYCAENIDAE				
<i>Cigaritis zohra</i>	P	<i>Coronilla minima</i> L.	2	1600 m
<i>C. allardi</i>	O	<i>Genista quadriflora</i> Munby	4	1500 m
	O	<i>Cistus saqlivifolius</i> L.	4	1500 m
<i>Lycaena phlaeas</i>	O	<i>Rumex thyrsoides</i> Desf. (<i>Rumex</i>)	2	1600 m
<i>Tomares ballus</i>	O	<i>Medicago</i> cf. <i>turbinata</i> (L.) All. (<i>Anthyllis tetraphylla</i> , <i>Erophaca boetica</i>)	1	1100 m
<i>Lampides boeticus</i>	P	<i>Onobrychis peduncularis</i> (Cav.) DC.	2	1600 m
	E/L	<i>Lotus moroccanus</i> Ball	1	1600 m
	P	<i>Trifolium angustifolium</i> L.	4	1500 m
	O	<i>Cytisus megalanthus</i> Pam. & FontQuer.	9	2350 m
	O	<i>Helianthemum helianthemoides</i> (Desf.) Grosser (<i>Dolychos lablab</i> , <i>Phaseolus vulgaris</i> , <i>P. multiflorus</i> , <i>Cajanus indicus</i> , <i>Spartium junceum</i> & <i>Cytisus battandieri</i>)	2	1600 m
<i>Cupido lorquinii</i>	E/P/L	<i>Anthyllis vulneraria</i> L.	1, 2, 4, 9, 10	1400-2600 m
	O	<i>Anthyllis</i> species*	2, 11	
<i>Glaucopsyche melanops</i>	E/P/L	<i>Ononis atlantica</i> Ball	1	1500 m
	O	<i>Adenocarpus anagyriifolius</i> Cossan & Bal	8	1700
<i>Pseudophilotes abencerragus</i>	P	<i>Medicago</i> cf. <i>turbinata</i> (L.) All.	1	1100 m
	O	<i>Thymus</i> cf. <i>hirtus</i> Willd.	1	1600 m
	O	<i>Salvia taraxicifolia</i> Cossan ex Hook. f.	8	1700 m
	O	<i>Thymus</i> species*	2	
<i>Scolitantides bavius Eversmann</i>	E/O	<i>Salvia</i> cf. <i>argentea</i>	2	1600 m
	E	<i>Salvia argentea</i> * (<i>Salvia argentea</i>)	2, 11	1600-1900 m
<i>Plebejus martini</i>	E/P/L	<i>Astragalus incanus</i> subsp. <i>incurvus</i> (Desf.) Chater	1	1500
	O	<i>A. incanus</i> *	12	
<i>Aricia agestis cramera</i>	O	<i>Erodium</i> species	6	2100 m
	O	<i>Erodium</i> species (Geraniaceae, <i>Helianthemum</i>)	8	1900 m
	P	<i>Onobrychis peduncularis</i> (Cav.) DC.	2	1600 m
<i>Polyommatus (Agrodiaetus) thersites</i> Cantener	O	<i>Onobrychis</i> species* (<i>Onobrychis</i>)	2	
	P	<i>Onobrychis peduncularis</i> (Cav.) DC.	2	1600 m
<i>P. (Lysandra) punctifera</i> Oberthur	E/O/P/L	<i>Hippocrepis scabra</i> DC.	2	1600 m
	O	<i>H. scabra</i> *	2, 12	1600-2150 m
	O	<i>P. (plebicula) atlanta</i>		2100 m
	O	by 1 female on <i>Onobrychis</i> species*	6	

NYMPHALIDAE

<i>Polygonia c-album</i>	O <i>Ribes uva-crispa</i> L. (<i>R. grossularia atlanticum</i> = <i>R. uva-crispa</i>)	8	2800 m
<i>Melitaea phoebe</i>	O <i>Centaurea</i> species (<i>Centaurea</i>)	6	2050 m
<i>Euphydryas desfontainii</i> Godart	O <i>Knautia</i> species (<i>Knautia arvensis</i>)	2	1600 m

Key to Localities

1. Ouaouizarhte, Middle Atlas. 1100 m altitude records from agricultural land adjacent to town. 1400-1600 m records from mountain and Rnim Colpizi pass to the north, mostly in *Quercus ilex* woodland and *Chamaerops humilis* steppe.
2. Ifrane, Middle Atlas. 1600 m, steppe, pasture and *Cedrus atlantica* forest close to town.
3. Col de Tanout, Middle Atlas. 2100 m, partly degraded *Q. ilex* woodland.
4. Azrou, Middle Atlas. 1500 m, regrowth of *Q. ilex* woodland following cutting, above the town.
5. Anjil Ikhatar, Middle Atlas. 1850 m, steppe vegetation on main P 20 road.
6. Col du Zad, Middle Atlas. 2100 m, valley meadows and degraded *C. atlantica* forest.
7. Setti Fadma, High Atlas. 1700 m, overgrazed mountainside in Ourika valley.
8. Ourika valley, High Atlas. 1900-2800 m, further up the valley from Setti Fadma. More overgrazed hillsides and terraced valley floor.
9. Oukaimeden, High Atlas. 2600 m, high plateau with alpine meadows and Lekak valley below.
10. Tizi-n-Tichka, High Atlas. 2350 m, above road pass in mostly degraded (overgrazed) alpine meadows.
11. Timhadite, Middle Atlas. About 1900 m. *S. bavius* record 8 km to east, overgrazed meadow.
12. Col Tairhempt, So. (Midelt) High Atlas. 2150 m, above road at summit of pass.

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Mating Confusion Between a Mimic and its Model: *Erynnis* (Hesperiidae) and *Euclidea* (Noctuidae)

Stamps and Gon (1983, Ann. Rev. Ecol. Syst. 14, p. 243), discussing the context of female-biased polymorphism in Lepidoptera, observe that "Occasionally, males of model species might court females of the mimicking species. . .then male mimicry could lead to cross-specific courtship, because females might mistake

courting model males for mimicking conspecific males. This potential confusion would be compounded because of frequency-dependence (i.e. model males would be more common than mimic males) and because Batesian mimicry can involve behavioral subtleties such as flight patterns or the choice of a microhabitat. At best, a female's confusion. . . would lead to a waste of her time and energy. . ." Observations of such interactions are, however, remarkably rare in the literature.

Diurnal flight has evolved twice in the *Drasteria* group of Noctuid moths. In each case there is a strong resemblance to sympatric and synchronic butterfly species which fits the general picture of Batesian mimicry: the butterflies (models) are phenotypically normal while the moths (mimics) depart markedly from the appearance of their relatives, in phenotype as well as in behavior. The "Blue Moth," *Caenurgina caerulea* Grt., is common in spring in foothill and lower montane habitats in California, flying sympatrically and synchronically with the Lycaenid *Celastrina argiolus echo* Edw. and other less common Blues. Two very similar species of *Euclidea*—*E. cuspeida* Hbn. in the East and *E. arditia* Franc. in the Western part of the United States and southern Canada—co-occur in spring with skippers of the genus *Erynnis* (Hesperiidae), from which they may be distinguished in flight only with difficulty. I have seen male *C. a. echo* investigate *C. caerulea* in the air, but never a courtship *per se* involving these species.

A male *Erynnis propertius* Scud. & Burg. was watched for over 3 min, beginning at 1305 hrs, 17 April 1984, as it courted a female *Euclidea arditia* in the understory of riparian oak woodland at Rossmoor Bar, Rancho Cordova, Sacramento County, California. The moth's flight was characteristically slow; it lit about four times but was immediately nudged into flight by the male's attempts at copulation. In the air the male hovered behind the female in the normal manner for *Erynnis* courtship, and it was not realized that the interaction was interspecific until the moth first lit. She took no apparent evasive action, but the pair was ultimately lost as they flew into thick shrubs. *Erynnis tristis* Bdv. was common in the area (about 20 seen); the *E. propertius* was the only example of its species seen. About ten *Euclidea* were seen flying in dappled light and shade in the area. Weather conditions were: scattered cumulus, air temperature ca. 22°C, SW wind 15 km/h. Insofar as I can determine, *Euclidea* courtship is undescribed. To a human observer, a male *Erynnis* is rather easily recognized by its rapid flight and territorial behavior, but females are virtually indistinguishable from *Euclidea* in the air—the resting posture, however, is easily diagnostic.

The basis for the inference of mimicry in *Caenurgina* and *Euclidea* is purely contextual, as neither of the presumed models is known or even suspected to be distasteful. However, there is increasing recognition that mimicry may be based on forms of undesirability other than unpalatability. The differential flight characteristics of *Erynnis* and *Euclidea*, for example, suggest that a poor probability of capture and a poor ratio of energy expended in pursuit to energy reward from capture would make *Erynnis* an undesirable or at least low-priority prey item. A case of this sort was described by Hespeneheide (1973, J. Entomol. (A) 48:40-56) involving mimicry of elusive, swift-flying Dipterans by beetles.

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